

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

HABITAT AND RESTORATION DIVISION

333 RASPBERRY ROAD
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December 1, 1997

Mr. Gary Gustafson
Heritage Land Bank
Municipality of Anchorage
632 West 6th Avenue
Anchorage, AK 99519-6650

Dear Mr. Gustafson:

Attached is the completed Glacier Valley Fish Survey report per contract # IHP-98-008. We hope these data are useful to you. Please call me at 267-2279 or Ed Weiss at 267-2305 if you have any questions regarding this report.

Sincerely,



Don McKay
Habitat Biologist
Region II
(907) 267-2285

Enclosure

cc: D. Hill, ADF&G
G. Muhlberg, ADF&G
M. Weston York

Mr. Gary Gustafson

-2-

December 1, 1997

bcc Waters File (247-60-10250)
 Stream Survey File

INTRODUCTION

In order to provide the Municipality of Anchorage with a general knowledge of fish species and fish habitat within the proposed Girdwood Golf Course project study area, the Heritage Land Bank (HLB) contracted with the Alaska Department of Fish and Game (ADF&G) Habitat and Restoration Division to conduct stream surveys during the late summer and fall of 1997. Within the Girdwood Golf Course project study area (Figure 1) the California, Glacier, and Virgin Creek drainages were sampled for the presence of adult and juvenile fish. ADF&G understands that the results of this survey will aid in the Municipality of Anchorage's evaluation of proposals to design, construct, and operate a golf course in the Glacier Valley.

The study area is located in the lower reach of Glacier Valley, south and east of the Alyeska Highway and north and east of the Seward Highway. California Creek, Glacier Creek, and Virgin Creek run through the study area. All three creeks flow in a generally southwesterly direction and drain into Turnagain Arm. California Creek joins Glacier Creek immediately upstream and north of the Alaska Railroad bridge.

California Creek (AWC #247-60-10250-2007), Glacier Creek (AWC# 247-60-10250), and Virgin Creek (AWC #247-60-10248) are specified anadromous fish streams in the ADF&G's "Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes" (1996). California Creek is specified as being utilized by adult chinook salmon, coho salmon, and pink salmon to a point upstream of the study area. Glacier Creek is specified to a point upstream of the study area as being utilized by chinook, coho, sockeye, chum, and pink salmon. Coho salmon rearing areas within the California Creek drainage are documented upstream and downstream of the study area. Virgin Creek is specified to a point upstream of the study area as being utilized by chum salmon and pink salmon. Coho salmon rearing areas within the Virgin Creek drainage are documented downstream of the study area.

Fish habitat data collected during this survey will be used to expand the information base of the ADF&G's "Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes" (1996).

METHODS

Fish sampling was conducted between 8/4/97 and 10/14/97. Adult anadromous fish surveys were conducted on foot; visual observations were made and recorded throughout the study area. However, to aid access, an inflatable raft was used on Glacier Creek during two survey periods of high water. When necessary, polarized glasses were used to enhance visibility.

GLACIER VALLEY FISH SURVEY REPORT

Prepared By
Doug Hill
Ed Weiss

Alaska Department of Fish and Game
Habitat and Restoration Division

November 24, 1997

Juvenile fish were sampled with 1/8" and 1/4" mesh cone minnow traps. Cured and non-cured salmon roe was used as bait. Minnow trap set duration varied from a few hours to two nights. The majority of sets were one night. Captured juveniles were counted, identified to species, and measured to the nearest millimeter fork length. Juvenile fish were then returned to the location where they were captured.

Color photocopies of aerial photos depicting the entire study area were obtained from the Municipality of Anchorage. The photos were taken on 5/23/97 in the scale of 1" = 500'. Locations where adult salmon were observed and minnow traps were set were identified on the aerial photocopies (Figures 2 through 12).

General observations of habitat types in the vicinity of adult observation locations and minnow trap set locations were recorded. Notes on stream character, stream stage, water clarity and wildlife observations were also taken.

California Creek drainage study area:

Area 1) The mainstem and associated minor tributaries. The mainstem is divided at stream segment E/G by a beaver dam that is greater than 5 feet high. The dam has created a pond that has flooded beyond the creek channel, well into the spruce/cottonwood/alder canopy and upstream approximately 300 feet. A number of overflow channels flow out of this pond and join California Creek downstream of the dam. Above and below the beaver pond California Creek is a meandering stream with a few tributaries; some are dammed by smaller beaver dams. Cobble/gravel/sand substrate is found above and below the beaver pond.

Area 2) The tributary that runs in a southeasterly direction and joins California Creek just upstream of the Ruane Road culvert.

Area 3) The wetland area that drains in a north-northeasterly direction and joins California Creek in stream segment D.

Glacier Creek drainage study area:

Area 1) Mainstem Glacier Creek and all associated braids and sloughs.

Area 2) Tributary system consisting of two streams that flow out of the Alyeska Basin Subdivision and join within the northeast corner of the study area immediately south of the Glacier Creek mainstem.

Area 3) Tributary system consisting of apparently inactive but stable beaver dams lying between Glacier Creek and Virgin Creek southwest of the Girdwood sewage treatment plant and west-northwest of the Virgin Creek lower mainstem beaver pond.

Virgin Creek drainage study area:

Area 1) The upper mainstem. The upper mainstem is a relatively higher gradient, high velocity, step pool/cascade stream with a cobble/boulder/bedrock substrate.

Area 2) The lower mainstem. The lower mainstem is a relatively lower gradient, lower velocity, meandering stream with a sand/gravel/cobble substrate. The lower mainstem also includes a beaver dam system which lies on the north side of the creek.

The boundary between the upper and lower mainstem lies approximately at set number 8/27-MV2 (Figure 12).

Area 3) A drainage independent of Virgin Creek has been treated in the data as if it is part of the Virgin Creek drainage. This drainage lies to the south and east of lower Virgin Creek and is within a wetland area which flows through a series of beaver dams before flowing into Turnagain Arm. Sets 9/8-MV1 through 9/8MV7 (Figure 12) represent the drainage to the south.

The following is a brief description of the survey activities:

8/4-5/97---Preliminary exploratory survey. August 4 - Glacier Creek and California Creek were surveyed for the presence of adult anadromous fish. August 5 - Virgin Creek was surveyed for the presence of adult anadromous fish. Minnow traps were set and retrieved on California Creek, Glacier Creek, and Virgin Creek (4 traps per creek).

8/20/97---California Creek, Glacier Creek and Virgin Creek were surveyed for the presence of adult anadromous fish.

8/25-26-27/97---August 25 - California and Glacier Creeks were surveyed for the presence of adult anadromous fish. Minnow traps were set in both drainages (13 in California Creek and 11 in Glacier Creek). August 26 - Minnow traps were pulled from California Creek. Only a portion of the Glacier Creek traps were pulled due to high water. August 27 - The remaining Glacier Creek traps were pulled via inflatable raft.

8/27-28/97---August 27 - Virgin Creek was surveyed for the presence of adult anadromous fish. Eleven minnow traps were set on Virgin Creek. August 28 - Minnow traps were pulled from Virgin Creek.

9/8-9/97---September 8 - Minnow traps were set in the California Creek, Glacier Creek, and Virgin Creek drainages (10 set in California Creek, 7 set in Glacier Creek

and 7 in Virgin Creek). September 9 - Minnow traps were pulled. Four minnow traps were set and pulled on upper Virgin Creek.

9/29-30/97 - September 29 - The California and Glacier Creek drainages were surveyed for the presence of adult anadromous fish. Minnow traps were set in all three drainages (6 in California Creek, 7 in Glacier Creek, and 5 in Virgin Creek). 9/30/97 - The Virgin Creek drainage was surveyed for the presence of adult anadromous fish. Minnow traps were pulled.

10/13-14/97---October 13 - Minnow traps were set in the California Creek, Glacier Creek, and Virgin Creek drainages (6 in California Creek, 9 on Glacier Creek and 4 in Virgin Creek). October 14 - California Creek, Glacier Creek, and Virgin Creek drainages were surveyed for the presence of adult anadromous fish. Minnow traps were pulled from all drainages.

RESULTS

A total of 111 minnow trap sets were made of which 89 sets were one night sets, 6 sets were two night sets, and 16 sets were pulled within a few hours after setting. Significant numbers of juvenile chinook and coho salmon and Dolly Varden were caught in minnow traps over most of the sampled area and throughout the duration of the survey. Stickleback and sculpin were also caught.

Five adult surveys were conducted on each creek within the study. Table 5, "Adult Observations", lists six dates for Virgin Creek. The extra date, 9/29/97, only records the presence of a coho salmon carcass on Virgin Creek; the first sign of adult activity. Modest numbers of adult chinook, coho, sockeye, chum and pink salmon were observed in the study area. At least one species of adult salmon was present in the study area throughout the duration of the survey.

California Creek

Adult Observations

Adult survey data are summarized in Table 1. Locations where adult fish were observed are shown in Figure 2.

Adult chinook, coho, sockeye, chum and pink salmon were observed in the California Creek drainage during the 1997 survey. Coho, sockeye, chum, and pink salmon were observed spawning in California Creek. Coho salmon were the furthest upstream migrants within the study area. Coho salmon were observed up to and within stream segment H. Chinook salmon were observed in stream segment A. Chinook, chum, and pink salmon were observed up to and within stream segment E.

Adult salmon were typically observed in lower velocity portions of the creek such as: relatively deeper water pools, pools at the base of riffles, downstream of and beneath woody debris and overhanging vegetation, and beneath cutbanks. Fish were also observed in low gradient riffles which had a gravel substrate with a low percentage of cobble.

Minnow Traps

Trap catch data for California Creek are summarized in Table 2. Locations where minnow traps were set are shown in Figures 3 and 4.

Juvenile coho salmon, chinook salmon and Dolly Varden were captured throughout the portion of the California Creek drainage within the study area. A total of 1109 coho salmon, 396 chinook salmon, and 260 Dolly Varden were captured during the project sampling. Juvenile chinook salmon were caught primarily in the mainstem of the California Creek drainage; a few were caught in the tributaries. Juvenile coho salmon were caught in significant numbers throughout the California Creek drainage. Coho salmon were caught in the mainstem and tributaries. Juvenile coho salmon were found nearly everywhere water was present. Dolly Varden were captured primarily in the mainstem and to a lesser degree in the tributaries of the California Creek drainage. Dolly Varden catches were very low in the tributary waters that join California Creek on the north bank just upstream of the Ruane Road culvert.

Micro-habitat preferences were similar for chinook and coho salmon and Dolly Varden. Juvenile fish were captured in a variety of micro-habitat types including: along the stream banks and beneath cutbanks; beneath woody debris piles; within emergent vegetation; above and below beaver dams; in pools and shallows.

Water clarity in California Creek was fair to good during most of the surveys. Poor visibility was experienced on the 9/25/97 survey due to high muddy water.

Glacier Creek

Adult Observations

Adult survey data are summarized in Table 3. Locations where adult fish were observed are shown in Figure 5 and 6.

Adult coho and chum salmon were observed in the portion of the Glacier Creek drainage within the study area between 8/20/97 and 10/14/97. One chinook salmon carcass was found at site 8/20-AG7 (Figure 6). Coho salmon migrated farthest upstream. Coho salmon were observed from the upstream point 10/14-AG1 (Figure 5) to the downstream point 10/14-AG5 (Figure 6). Chum salmon were observed from the upstream point 8/20-AG1 (Figure 6) to the downstream point 8/20-AG8 (Figure 6). Both coho and chum salmon were observed exhibiting spawning behavior throughout the stream segments described above.

Coho and chum salmon were observed primarily in relatively low velocity, pool-like segments of side braids. A few coho and chum salmon were observed in the mainstem beneath woody debris and cutbanks where relatively low water velocities occurred. Coho and chum salmon were also observed at the base of a beaver dam approximately 50 feet upstream on a tributary of the mainstem; in a still, shallow pool (Figure 6; 8/20-AG6, 9/29-AG2, and 10/14-AG5).

Minnow Traps

Minnow trap catch data are summarized in Table 4. Locations where minnow traps were set are shown in Figures 7, 8, and 9.

Juvenile coho salmon, chinook salmon and Dolly Varden were caught throughout the portion of the Glacier Creek drainage within the study area. A total of 402 coho salmon, 405 chinook salmon, and 207 Dolly Varden were caught. Juvenile chinook salmon were caught primarily in the mainstem and to a lesser extent in braids/sloughs that were directly connected to the mainstem of Glacier Creek. Trap success was poor in waters above a few apparently inactive but stable beaver dams. Juvenile chinook salmon were caught in relatively lower velocity waters of the mainstem; i.e., along the bank, beneath cutbanks, in and beneath woody debris piles and vegetation, in scour pools, and in the smaller side braids and sloughs. Juvenile coho salmon were caught throughout the Glacier Creek drainage. Juvenile coho were observed nearly everywhere water was present. They were found in micro-habitat similar to that described for juvenile chinook. Dolly Varden were caught throughout the Glacier Creek drainage in micro-habitat similar to that described above for chinook salmon and coho salmon.

Glacier Creek was turbid with glacial silt during all surveys except the 10/14-15 survey. Hence, adult observation was more likely in low velocity stream segments where silt had settled out of the water column and, in shallow sections of the stream.

Virgin Creek

Adult Observations

Adult survey data are summarized in Table 5. Locations of adult fish were observed are shown in Figure 10.

Adult coho salmon were observed in the portion of the Virgin Creek drainage within the study area on 9/30/97 and 10/14/97. An adult coho carcass was found in the creek on 9/29/97 (Adult Observation # 9/29-AV1; Figure 10). Adult observation # 9/30-AV1 (Figure 10) denotes the farthest upstream coho salmon migration observed in Virgin Creek. Coho spawning behavior was observed at adult observation numbers 9/30-AV1, AV2 and AV4 (Figure 10). Coho salmon were observed holding in relatively deeper water (1.5' plus), in pools, beneath woody debris and beneath cutbanks.

Minnow Traps

Minnow trap catch data are summarized in Table 6. Locations where minnow traps were set are shown in Figures 11 and 12.

A total of 98 juvenile coho salmon and 234 Dolly Varden were caught in the Virgin Creek drainage. Juvenile coho salmon were caught primarily in the lower mainstem. Three coho salmon were caught in the upper mainstem. These fish were caught less than 100 yards upstream of the upper/lower boundary (set numbers 9/29-MV1 and 2; Figure 11). The farthest upstream coho salmon captured was at set number 9/29-MV1 (Figure 11). No coho salmon were captured in the independent drainage southeast of Virgin Creek. Dolly Varden were found throughout the drainage from the upstream boundary of the study area to the downstream boundary of the study area. The majority of Dolly Varden were caught in the lower mainstem. Catches were relatively small in the upper mainstem and in the independent drainage southeast of Virgin Creek. Coho salmon and Dolly Varden were found along banks, beneath cutbanks, in and beneath woody debris and vegetation, above and below beaver dams and in pools and shallows.

Water clarity in Virgin Creek was good during all surveys.

DISCUSSION

Current information on anadromous fish distribution within the study area is shown in Figure 13.

California Creek

Fish sampling data from this survey indicate that the California Creek drainage within the study area supports chinook salmon, coho salmon, sockeye salmon, chum salmon, pink salmon, Dolly Varden, sculpin and stickleback. California Creek provides spawning habitat for chinook, coho, chum, sockeye, and pink salmon. Sampling efforts also indicate that the California Creek drainage provides rearing habitat for chinook and coho salmon.

Prior to this survey, the portion of the California Creek drainage within the study area was not documented in the anadromous water catalog as habitat for sockeye and chum salmon spawning. Additionally, the study area portion of the drainage was not documented as rearing habitat for juvenile chinook and coho salmon. Data collected during this survey will be submitted for inclusion in the anadromous waters catalog.

Glacier Creek

Fish sampling data from this survey indicate that the Glacier Creek drainage within the study area supports chinook salmon, coho salmon, chum salmon, Dolly Varden, and sculpin. Observations indicate that the Glacier Creek drainage provides spawning habitat for coho and chum salmon. The Glacier Creek drainage also provides rearing habitat for chinook and coho salmon. Prior to this survey, the portion of the Glacier Creek drainage within the study area was not documented in the anadromous waters catalog as habitat for rearing juvenile chinook and coho salmon. Data collected during this survey will be submitted for inclusion in the anadromous waters catalog.

Virgin Creek

Fish sampling data from this survey indicate that the Virgin Creek drainage within the study area provides spawning and rearing habitat for coho salmon.

Prior to this survey, the portion of the Virgin Creek drainage within the study area was not documented in the anadromous waters catalog as coho salmon spawning or rearing habitat. Data collected during this survey will be submitted for inclusion in the anadromous waters catalog.

Adult salmon counts may be low for California Creek and are certainly low for Glacier Creek. Adults may have been missed on both creeks due to fish residing in deep water, under stream banks and beneath woody debris and vegetation. In addition, adults may have been missed in California Creek as a result of high muddy water on the 8/25/97 count. Glacier Creek was heavily silt laden on all surveys except the 10/14/97 survey. Hence, visibility was poor and fish were likely missed. Visibility on the 10/14/97 survey was only fair and fish may have also been missed.

Chinook salmon were not observed spawning in the California Creek and Glacier Creek drainages, however widespread distribution of chinook salmon fry indicates spawning activity within these systems. California and Glacier Creeks are documented in the anadromous waters catalog as habitat for adult chinook salmon. Surveying earlier in the season would likely provide additional information on use chinook salmon.

As mentioned above, during this survey, adult sockeye, chum and pink salmon were observed spawning in the California Creek drainage. Chum and pink salmon were also observed spawning in the Glacier Creek drainage. No juvenile sockeye, chum or pink salmon were captured. This absence is not an indication that juvenile habitat for these three species is not provided by California Creek and/or Glacier Creek. In addition, chum and pink salmon outmigrate soon after emerging as fry from the gravel. The same may also be true for the sockeye salmon. Additionally, juvenile sockeye, chum, and pink salmon are plankton feeders and therefore, are not typically attracted to baited minnow traps.

The minimum and maximum fork length of juvenile coho and chinook salmon in the California, Glacier, and Virgin Creek drainages were as follows:

<u>California Creek</u>	Minimum Fork Length (mm)	Maximum Fork Length (mm)
Coho	39	129
Chinook	52	125
<u>Glacier Creek</u>		
Coho	43	120
Chinook	49	164
<u>Virgin Creek</u>		
Coho	70	140

The span observed between the minimum and maximum length in both species indicates the presence of multiple year classes. In other words, at least two years (1995 and 1996) of spawning activity are probably represented.

Due to the relatively low amount of precipitation during the summer, observations suggest that water levels, especially in the California and Virgin Creek drainages, may have been lower than normal. Hence, juvenile salmon may not have been as widely distributed as in years of higher precipitation. The results of this reconnaissance survey document a limited distribution of rearing salmonids. During wetter years, additional habitat may be accessible to juvenile salmon. One season's data is a narrow representation of habitat, fish timing, numbers, and habitat usage. Fish habitat and fish populations are dynamic and thereby fluctuate from year to year.

TABLE 1
CALIFORNIA CREEK
AWC # 247-60-10250-2007
ADULT FISH OBSERVATIONS

DATE	LIVE/DEAD COUNT					LOCATION	FIGURE #
	CO	K	CH	P	S		
8/4/97	0/0	4/0	0/0	4/0	0/0	A	1
"	0/0	0/0	0/0	6/0	0/0	B	1
Total	0/0	4/0	0/0	10/0	0/0		
8/20/97	0/0	0/0	0/*	30/*	0/*	A	1
"	0/0	0/0	38/*	15/*	0/*	B	1
"	0/0	0/0	55/*	23/*	3/*	B	1
"	0/0	0/0	2/*	0/*	5/*	D	1
"	0/0	0/0	25/*	5/*	0/*	D	1
"	0/0	0/0	17/*	1/*	3/*	E	1
"	0/0	0/0	30/*	0/*	0/*	E	1
Total	0/0	0/0	167	74	11		
8/25/97	0/0	0/0	6/0	9/4	0/0	A	1
"	0/0	0/0	10/1	4/5	7/0	B	1
"	13/0	0/0	27/5	10/6	8/0	C	1
"	2/0	0/0	30/5	6/0	24/3	D	1
Total	15/0	0/0	73/11	29/15	39/3		
9/29/97	1/NA	0/*	0/*	0/*	0/*	B	1
"	4/NA	0/*	0/*	0/*	0/*	D	1
"	14/NA	0/*	0/*	0/*	0/*	E	1
"	12/NA	0/*	0/*	0/*	0/*	F	1
"	6/NA	0/*	0/*	0/*	0/*	F/G	1
"	2/NA	0/*	0/*	0/*	0/*	G	1
"	6/NA	0/*	0/*	0/*	0/*	H	1
Total	45/NA	0/*	0/*	0/*	0/*		
10/14/97	6/0	0/0	0/0	0/0	0/0	A	1
"	5/0	0/0	0/0	0/0	0/0	B	1
"	1/0	0/0	0/0	0/0	0/0	B	1
"	1/0	0/0	0/0	0/0	0/0	C	1
"	12/0	0/0	0/0	0/0	0/0	D	1
"	9/0	0/0	0/0	0/0	0/0	H	1
"	8 unidentified carcasses.						
Total	34/0	0/0	0/0	0/0	0/0		

CO---Coho Salmon

*Carcasses not counted.

K---Chinook Salmon

CH---Chum Salmon

S---Sockeye Salmon

P---Pink Salmon

TABLE 2
CALIFORNIA CREEK
AWC # 247-60-10250-2007
MINNOW TRAP CATCH DATA

DATE TIME IN	SET #	# FISH/TRAP (By Species)					TOTAL # FISH/TRAP	FIGURE #
		CO	K	DV	SC	ST		
8/5/97	MC1	2	4	16	0	0	22	2
8/5/97	MC2	5	0	2	0	0	7	2
8/5/97	MC3	2	2	14	0	0	18	2
8/5/97	MC4	2	10	4	0	0	16	2
Trap Total		11	16	36	0	0	63	
8/25/97	MC1	10	11	11	0	0	32	3
8/25/97	MC2	121	0	0	0	5	126	3
8/25/97	MC3	8	0	0	0	0	8	3
8/25/97	MC4	0	0	0	0	0	0	3
8/25/97	MC5	12	74	8	0	0	94	2
8/25/97	MC6	70	3	1	0	0	74	2
8/25/97	MC7	12	51	2	3	0	68	2
8/25/97	MC8	8	17	21	0	0	46	2
8/25/97	MC9	20	7	11	1	0	39	2
8/25/97	MC10	10	30	16	1	0	57	2
8/25/97	MC11	20	7	19	0	0	46	2
8/25/97	MC12	27	43	21	0	0	91	2
8/25/97	MC13	1	9	4	0	0	14	2
Trap Total		319	252	114	5	5	695	
9/8/97	MC1	80	1	3	0	1	85	3
9/8/97	MC2	54	0	1	1	0	56	3
9/8/97	MC3	48	0	3	1	1	53	3
9/8/97	MC4	50	0	0	0	0	50	3
9/8/97	MC5	85	0	0	0	0	85	3
9/8/97	MC6	52	0	0	0	0	52	3
9/8/97	MC7	0	0	0	0	4	4	2
9/8/97	MC8	10	0	0	0	35	45	2
9/8/97	MC9	9	0	3	0	24	36	2
9/8/97	MC10	43	0	1	0	0	44	2
Trap Total		431	1	11	2	65	510	
9/29/97	MC1	2	0	0	0	0	2	2
9/29/97	MC2	47	5	18	0	0	70	2
9/29/97	MC3	75	5	17	0	0	97	2
9/29/97	MC4	60	0	3	0	0	63	2
9/29/97	MC5	31	5	2	0	0	38	2
9/29/97	MC6	53	11	16	0	0	80	2
Trap Total		268	26	56	0	0	350	
10/13/97	MC1	6	74	7	1	0	88	2
10/13/97	MC2	4	1	5	0	0	10	2
10/13/97	MC3	40	10	19	0	0	69	2
10/13/97	MC4	3	5	1	0	0	9	2
10/13/97	MC5	11	3	1	0	0	15	2
10/13/97	MC6	16	8	10	0	0	34	3
Trap Total		80	101	43	1	0	225	

CO---Coho Salmon
K---Chinook Salmon
DV---Dolly Varden
SC---Sculpin
ST---Stickleback

TABLE 3
GLACIER CREEK
AWC # 247-60-10250
ADULT FISH OBSERVATIONS

DATE	LIVE/DEAD COUNT					OBSERV #	FIGURE #
	CO	K	CH	P	S	(Location)	
8/4/97	Creek too silty to count.						
8/20/97	0/0	0/0	12/0	0/0	0/0	AG1	5
"	0/0	0/0	20/0	0/0	0/0	AG2	5
"	0/0	0/0	35/0	0/0	0/0	AG3	5
"	0/0	0/0	4/0	0/0	0/0	AG4	5
"	0/0	0/0	12/0	0/0	0/0	AG5	5
"	0/0	0/0	31/0	0/0	0/0	AG6	5
"	0/0	0/1	16/0	0/0	0/0	AG7	5
"	0/0	0/0	45/0	0/0	0/0	AG8	5
Total	0/0	0/1	175/2	0/0	0/0		
8/25/97	0/0	0/0	38/0	0/0	0/0	AG1	5
"	0/0	0/0	24/0	0/0	0/0	AG2	5
Total	0/0	0/0	62	0/0	0/0		
9/29/97	2/0	0/0	0/10	0/0	0/0	AG1	4
"	1/0	0/0	0/0	0/0	0/0	AG2	5
Total	3/0	0/0	0/10	0/0	0/0		
10/14/97	10/0	0/0	0/0	0/0	0/0	AG1	4
"	2/0	0/0	0/0	0/0	0/0	AG2	4
"	2/0	0/0	0/0	0/0	0/0	AG3	4
"	2/0	0/0	0/0	0/0	0/0	AG4	4
"	1/0	0/0	0/12	0/0	0/0	AG5	4
Total	17/0	0/0	0/12	0/0	0/0		

CO---Coho Salmon
K---Chinook Salmon
CH---Chum Salmon
P---Pink Salmon

TABLE 4
GLACIER CREEK
AWC # 247-60-10250
MINNOW TRAP/CATCH DATA

DATE TIME IN	SET #	# FISH/TRAP (By Species)					TOTAL # FISH/TRAP	FIGURE #
		CO	K	DV	SC	ST		
8/5/97	MG1	1	0	10	0	0	11	6
8/5/97	MG2	6	3	10	0	0	19	6
8/5/97	MG3	0	0	6	0	0	6	6
8/5/97	MG4	0	0	13	0	0	13	6
Trap Total		7	3	39	0	0	49	
8/25/97	MG1	4	41	2	0	0	47	7
8/25/97	MG2	12	10	4	0	0	26	7
8/25/97	MG3	0	40	5	0	0	45	7
8/25/97	MG4	7	3	17	4	0	31	7
8/25/97	MG5	10	9	49	3	0	71	7
8/25/97	MG6	3	7	10	0	0	20	7
8/25/97	MG7	1	14	2	0	0	17	7
8/25/97	MG8	Trap lost due to flood.						
8/25/97	MG9	7	16	6	0	0	29	7
8/25/97	MG10	1	0	12	0	0	13	7
8/25/97	MG11	13	27	6	0	0	46	7
Trap Total		58	167	113	7	0	345	
9/8/97	MG1	35	1	2	0	0	38	6
9/8/97	MG2	14	4	5	0	0	23	6
9/8/97	MG3	6	3	7	2	0	18	6
9/8/97	MG4	10	6	11	1	0	27	6
9/8/97	MG5	0	5	1	0	0	6	6
9/8/97	MG6	0	0	0	0	0	0	7
9/8/97	MG7	0	0	1	0	0	1	7
Trap Total		65	19	27	3	0	114	
9/29/97	MG1	38	5	9	0	0	14	7
9/29/97	MG2	46	0	5	0	0	51	7
9/29/97	MG3	14	0	0	0	0	14	7
9/29/97	MG4	74	0	1	0	0	75	7
9/29/97	MG5	27	0	0	0	0	27	8
9/29/97	MG6	0	0	0	0	0	0	8
Trap Total		199	5	15	0	0	219	
10/13/97	MG1	6	4	4	0	0	14	7
10/13/97	MG2	5	9	4	0	0	18	8
10/13/97	MG3	4	12	0	0	0	16	8
10/13/97	MG4	8	20	1	0	0	29	8
10/13/97	MG5	0	14	2	0	0	16	7
10/13/97	MG6	0	0	0	0	0	0	7
10/13/97	MG7	29	62	2	0	0	93	7
10/13/97	MG8	14	47	2	0	0	63	7
10/13/97	MG9	7	52	2	2	0	63	7
Trap Total		73	211	13	2	0	299	

CO---Coho Salmon
K---Chinook Salmon
DV---Dolly Varden
SC---Sculpin
ST---Stickleback

TABLE 5
VIRGIN CREEK
AWC 247-60-10248
ADULT FISH OBSERVATIONS

	LIVE/DEAD COUNT					OBSERV #	
DATE	CO	K	CH	P	S	(Location)	FIGURE #
8/4/97	0/0	0/0	0/0	0/0	0/0	NA	NA
Total	0/0	0/0	0/0	0/0	0/0		
8/20/97	0/0	0/0	0/0	0/0	0/0	NA	NA
Total	0/0	0/0	0/0	0/0	0/0		
8/25/97	0/0	0/0	0/0	0/0	0/0	NA	NA
Total	0/0	0/0	0/0	0/0	0/0		
9/29/97	0/1	0/0	0/0	0/0	0/0	AV1	9
Total	0/1	0/0	0/0	0/0	0/0		
9/30/97	2/0	0/0	0/0	0/0	0/0	AV1	9
"	1/0	0/0	0/0	0/0	0/0	AV2	9
"	2/1	0/0	0/0	0/0	0/0	AV3	9
"	3/0	0/0	0/0	0/0	0/0	AV4	9
"	1/0	0/0	0/0	0/0	0/0	AV5	9
Total	9/1	0/0	0/0	0/0	0/0		
10/14/97	1/0	0/0	0/0	0/0	0/0	AV1	9
Total	1/0	0/0	0/0	0/0	0/0		

CO---Coho Salmon
K---Chinook Salmon
CH---Chum Salmon
S---Sockeye
P---Pink Salmon

TABLE 6
VIRGIN CREEK
 AWC # 247-60-10248
MINNOW TRAP/CATCH DATA

DATE TIME IN	SET #	# FISH/TRAP (By Species)					TOTAL # FISH/TRAP	FIGURE #
		CO	K	DV	SC	ST		
8/5/97	MV1	0	KS	4	0	0	4	10
8/5/97	MV2	0	0	1	0	0	1	10
8/5/97	MV3	0	0	0	0	0	0	10
8/5/97	MV4	0	0	0	0	0	0	10
Trap Total		0	0	5	0	0	5	
8/27/97	MV1	1	0	2	0	0	3	11
8/27/97	MV2	0	0	15	0	0	15	11
8/27/97	MV3	2	0	6	0	0	8	11
8/27/97	MV4	0	0	0	12	0	12	11
8/27/97	MV5	0	0	27	0	0	27	11
8/27/97	MV6	14	0	7	0	0	21	11
8/27/97	MV7	29	0	3	0	0	32	11
8/27/97	MV8	9	0	2	0	0	11	11
8/27/97	MV9	6	0	0	0	0	6	11
8/27/97	MV10	13	0	0	0	0	13	11
8/27/97	MV11	6	0	13	0	0	19	11
Trap Total		80	0	75	12	0	167	
9/8/97	MV1	0	0	0	0	0	0	11
9/8/97	MV2	0	0	4	0	0	4	11
9/8/97	MV3	0	0	5	0	12	17	11
9/8/97	MV4	0	0	15	0	0	15	11
9/8/97	MV5	0	0	0	0	15	15	11
9/8/97	MV6	0	0	5	0	15	20	11
9/8/97	MV7	0	0	0	0	1	1	11
Trap Total		0	0	29	0	43	72	
9/9/97	MV1	0	0	6	0	0	6	10
9/9/97	MV2	0	0	8	0	0	8	10
9/9/97	MV3	0	0	2	0	0	2	11
9/9/97	MV4	0	0	0	0	0	0	11
Trap Total		0	0	16	0	0	16	
9/29/97	MV1	1	0	20	0	0	21	11
9/29/97	MV2	2	0	7	0	0	9	11
9/29/97	MV3	0	0	38	1	0	39	11
9/29/97	MV4	0	0	2	0	0	2	11
9/29/97	MV5	0	0	26	0	0	26	11
Trap Total		3	0	93	1	0	97	
10/13/97	MV1	0	0	2	0	0	2	11
10/13/97	MV2	0	0	2	0	0	2	11
10/13/97	MV3	12	0	4	0	0	16	11
10/13/97	MV4	3	0	8	0	0	11	11
Trap Total		15	0	16	0	0	31	

CO---Coho Salmon
 K---Chinook Salmon
 DV---Dolly Varden
 SC---Sculpin
 ST---Stickleback

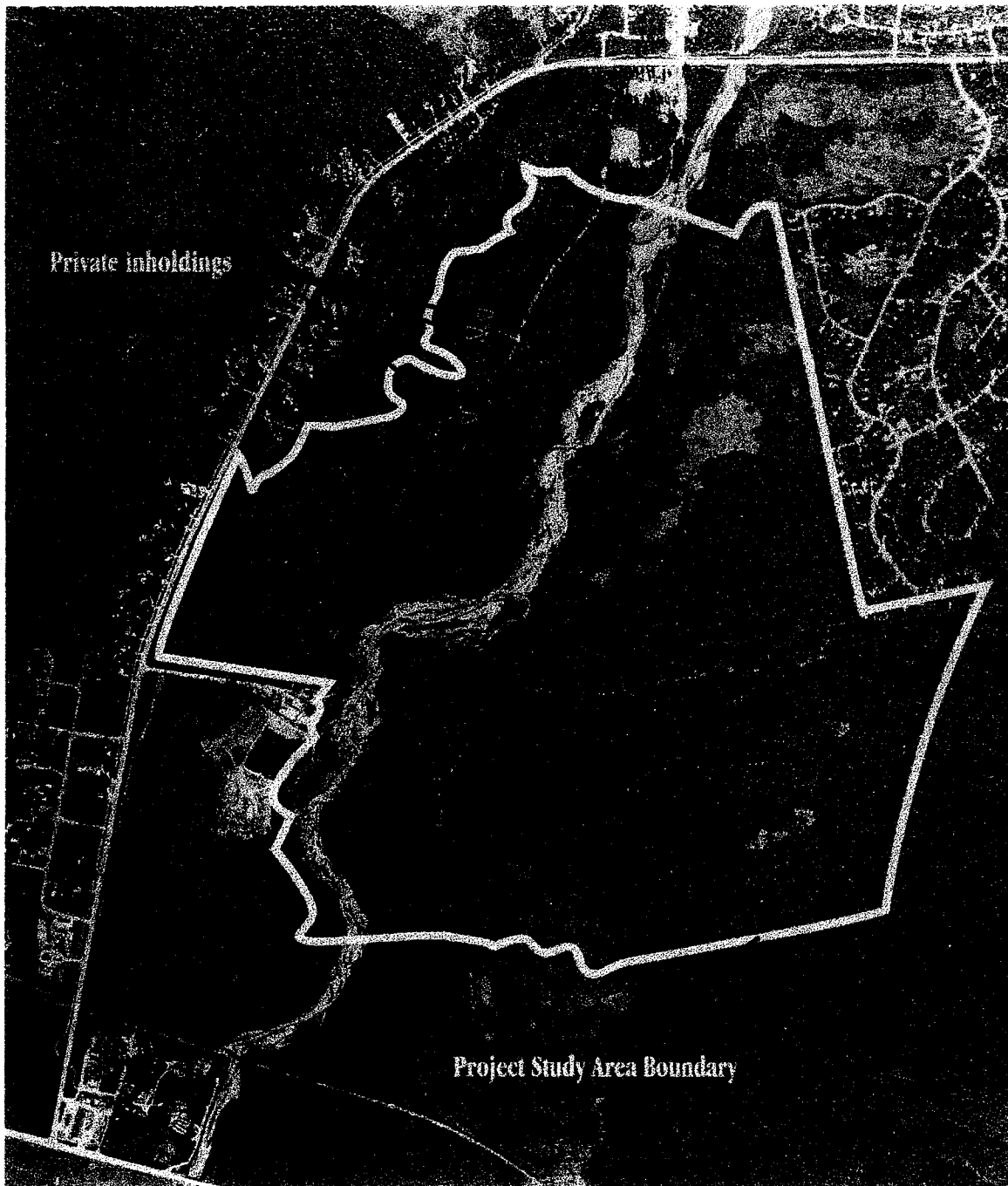


Figure 1. Study area.

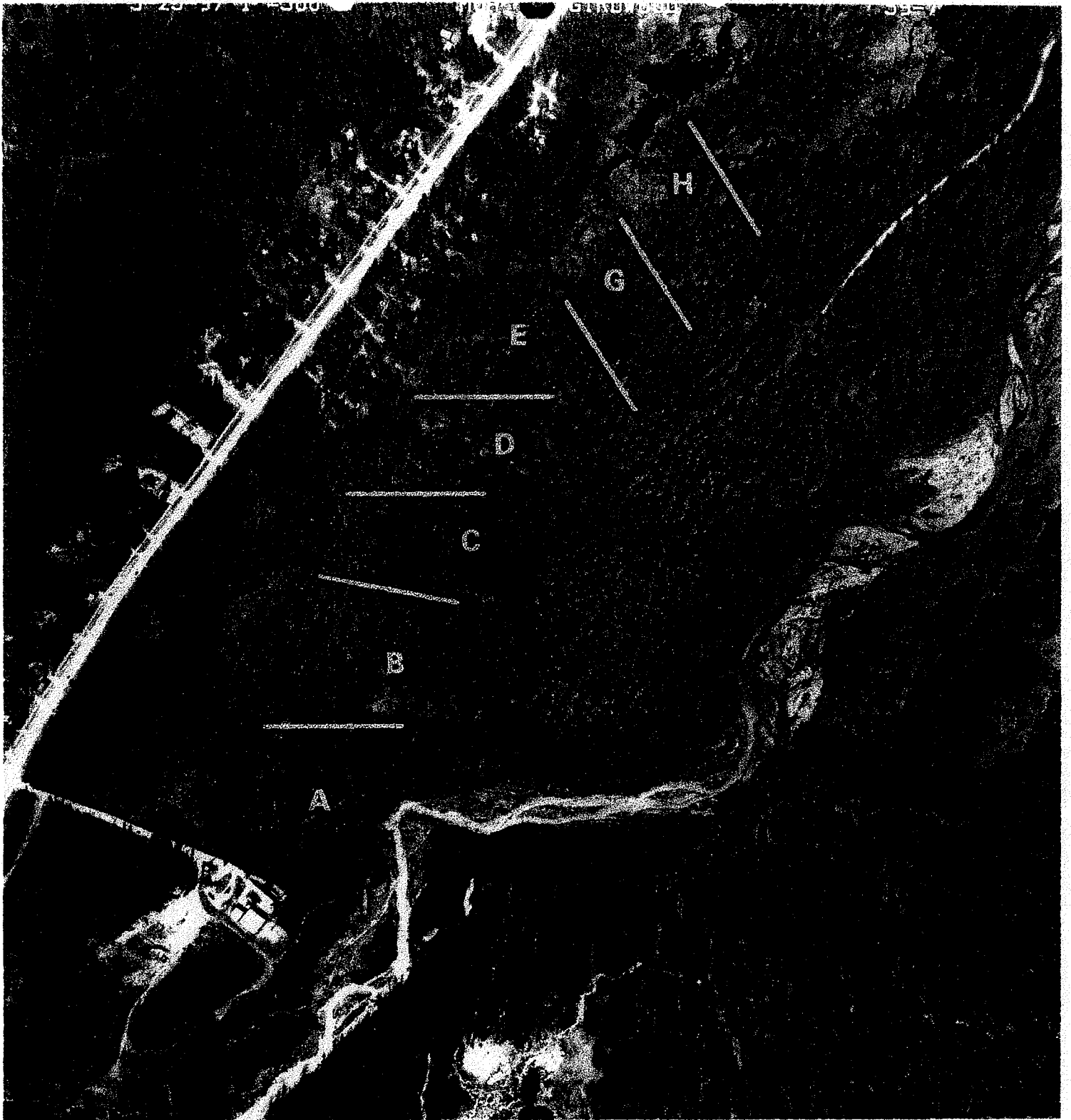
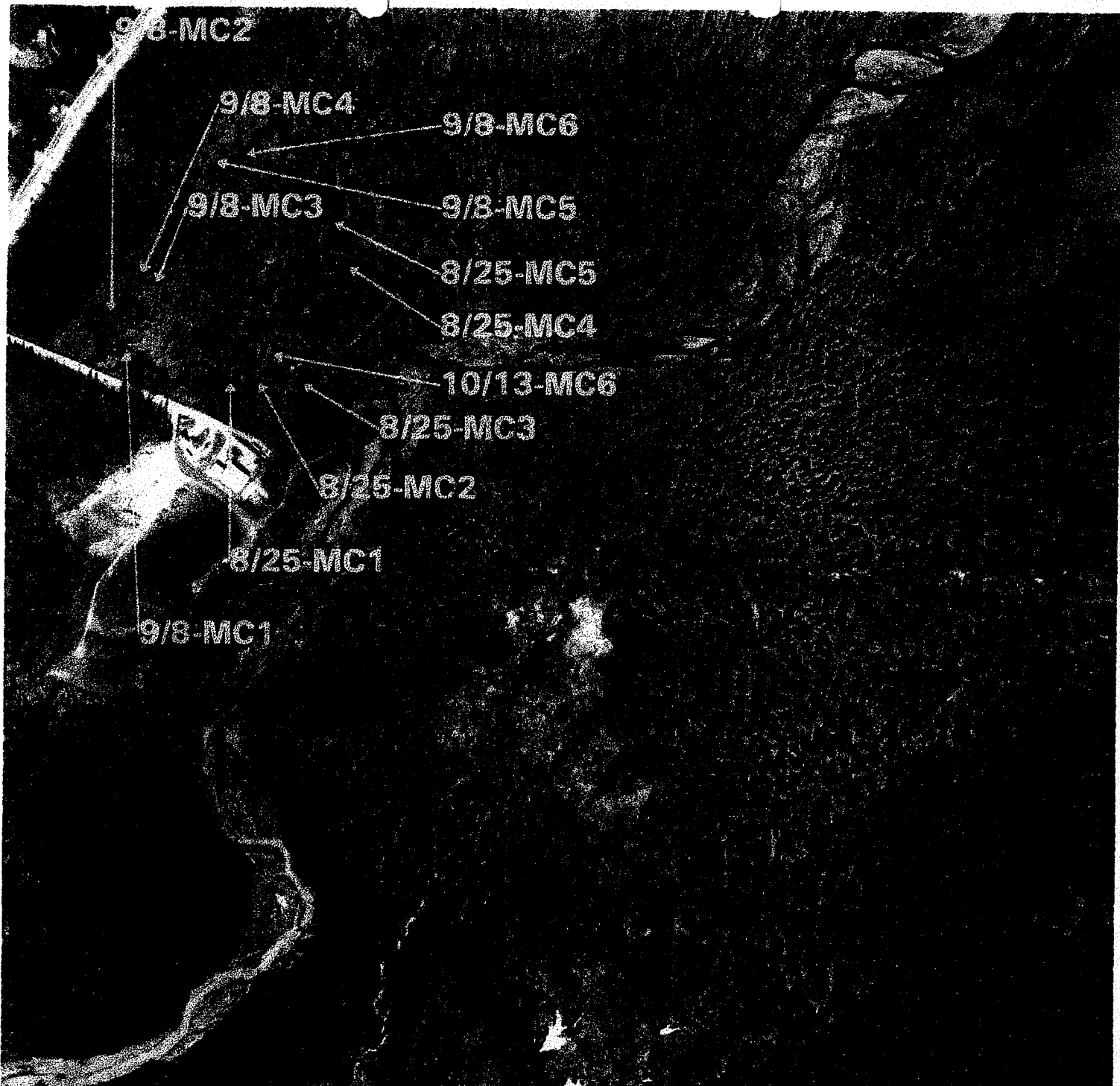


Figure 2. California Creek stream segments.

Aerial Photo # 59-7.



9/8-MC2

9/8-MC4

9/8-MC6

9/8-MC3

9/8-MC5

8/25-MC5

8/25-MC4

10/13-MC6

8/25-MC3

8/25-MC2

8/25-MC1

9/8-MC1

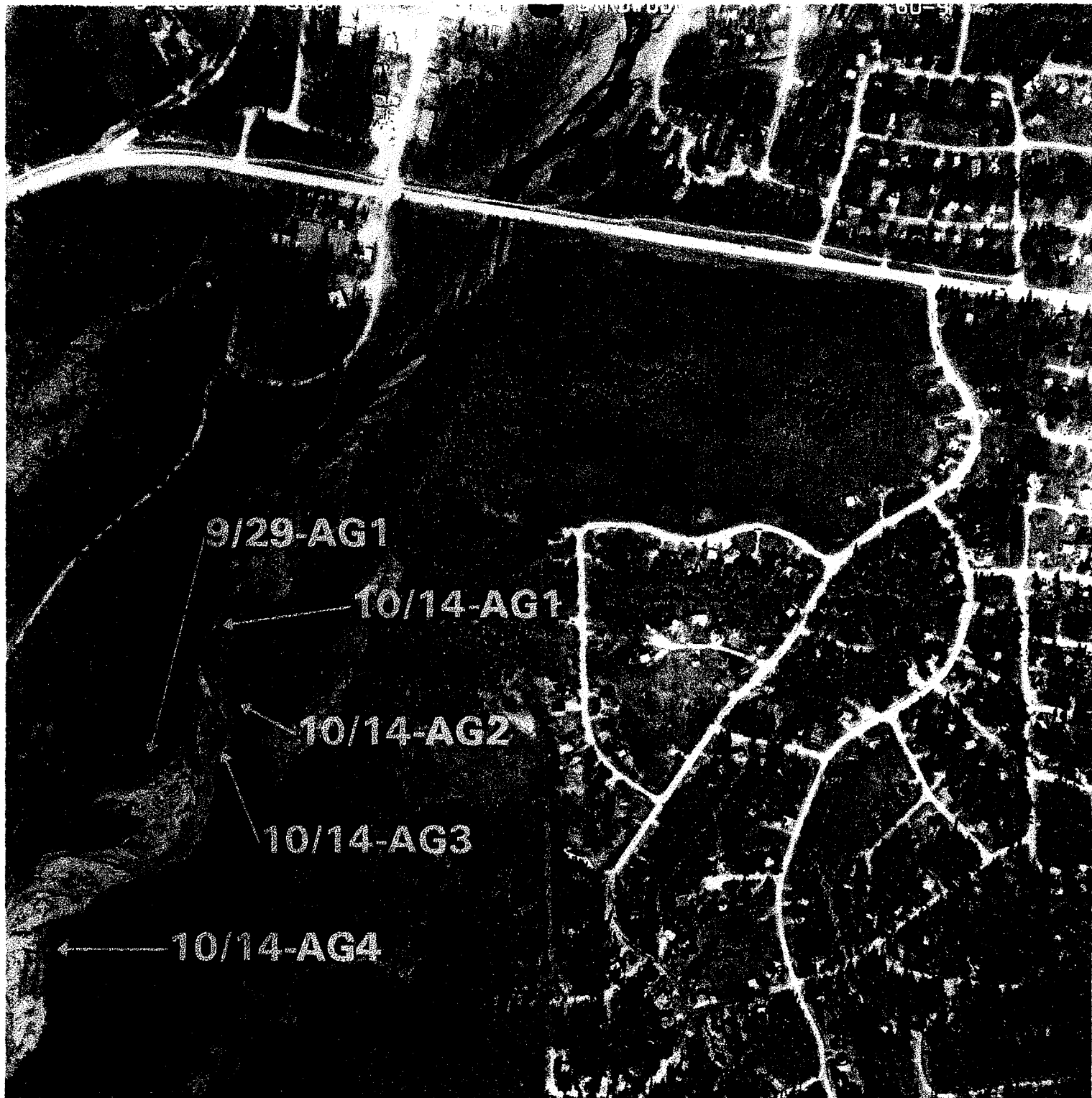


Figure 5. Glacier Creek adult observation sites.

Aerial Photo # 60-9

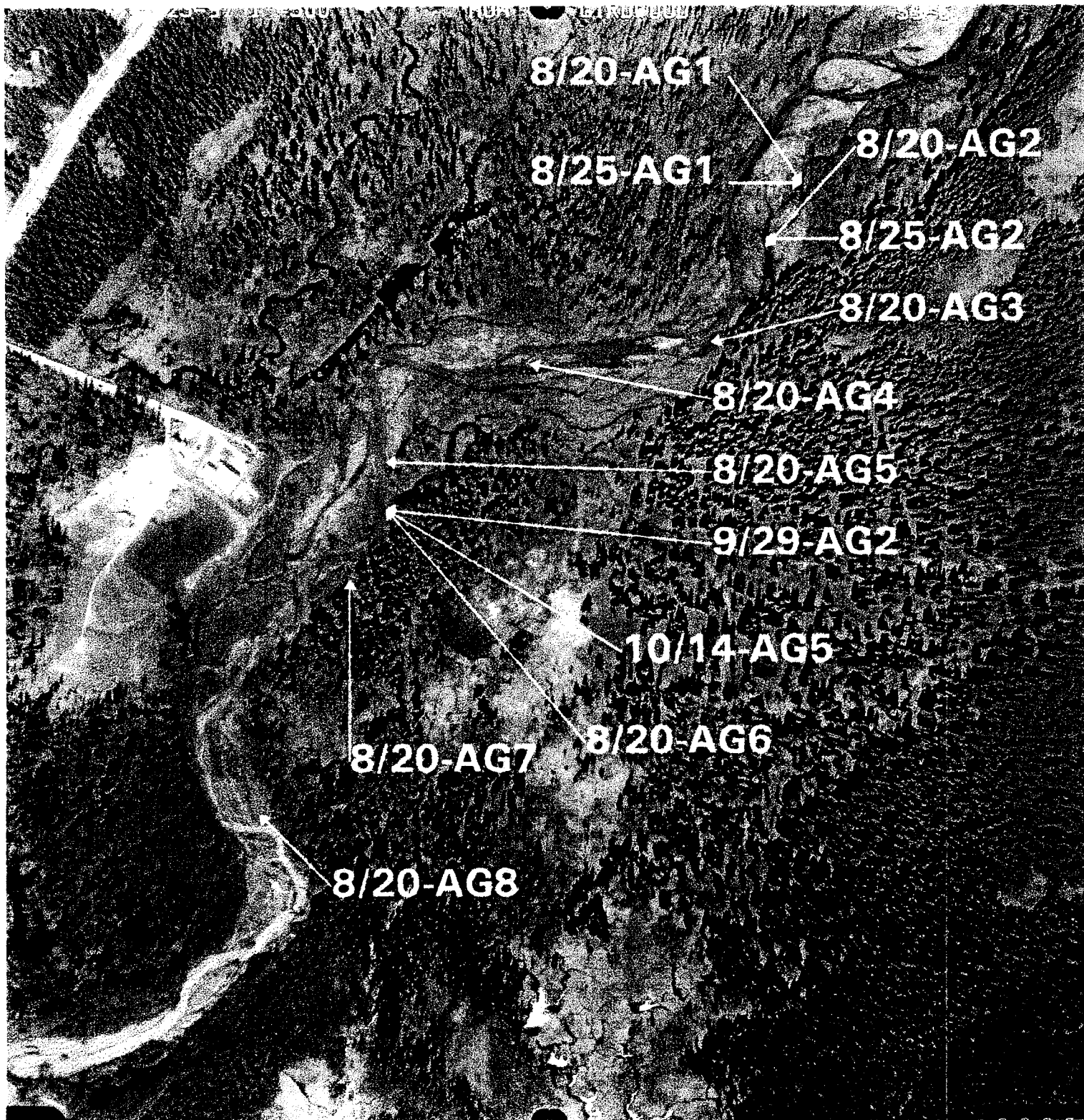


Figure 6. Glacier Creek adult observation sites.

Aerial Photo # 59-6

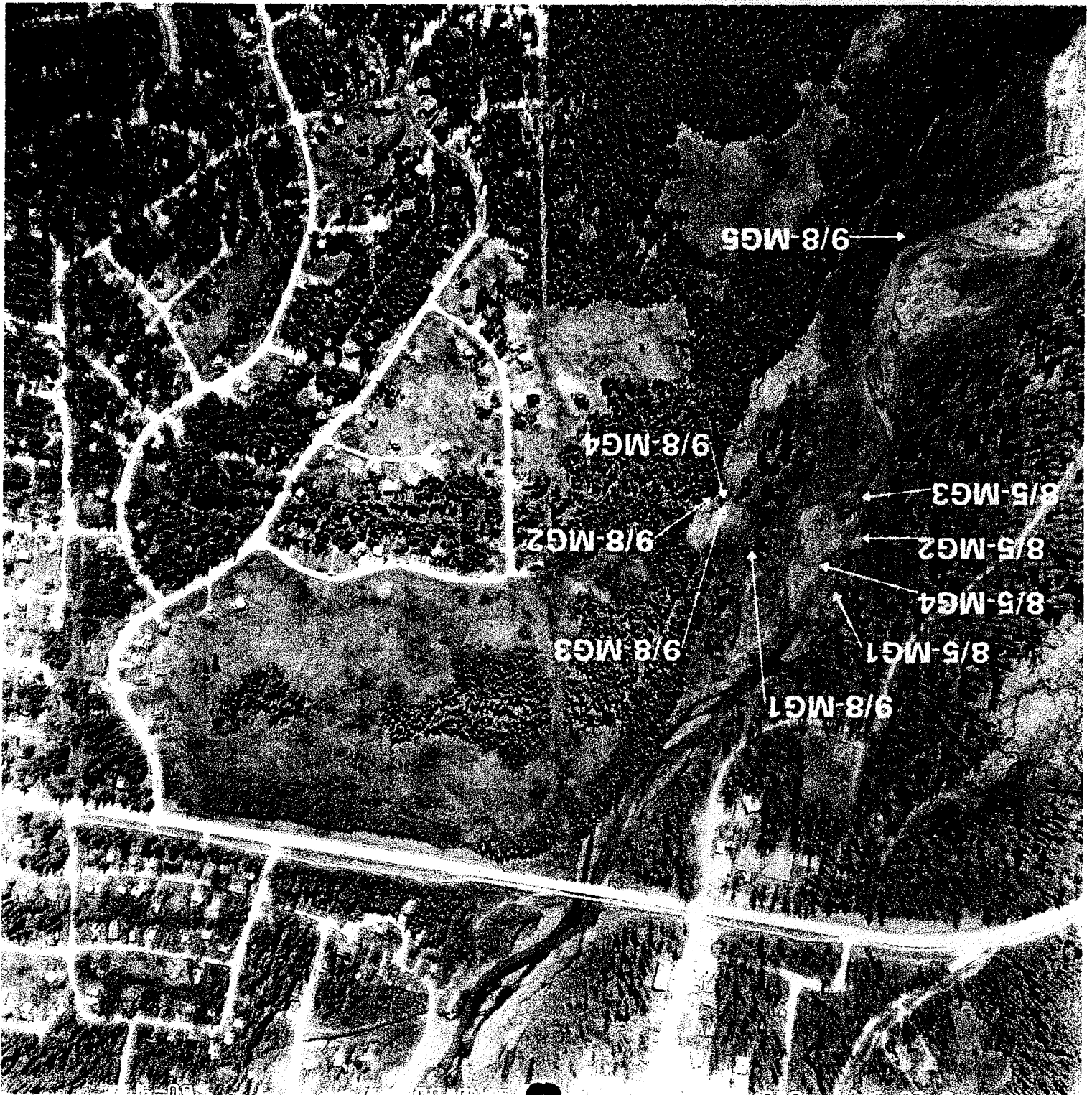


Figure 7. Glacier Creek juvenile trap sites.

Aerial Photo # 60-9

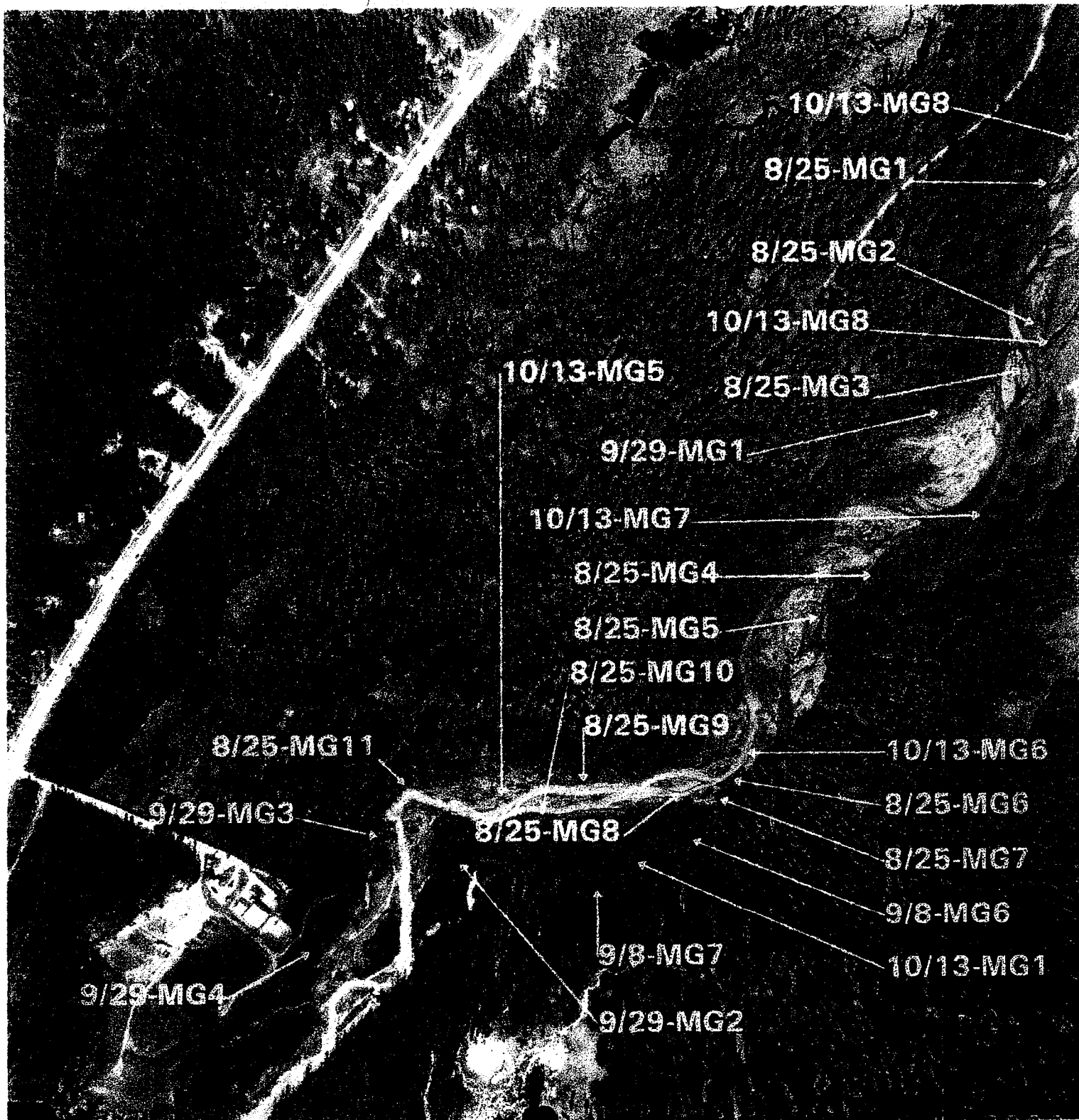


Figure 8. Glacier Creek juvenile trap sites.

Aerial Photo # 59-7

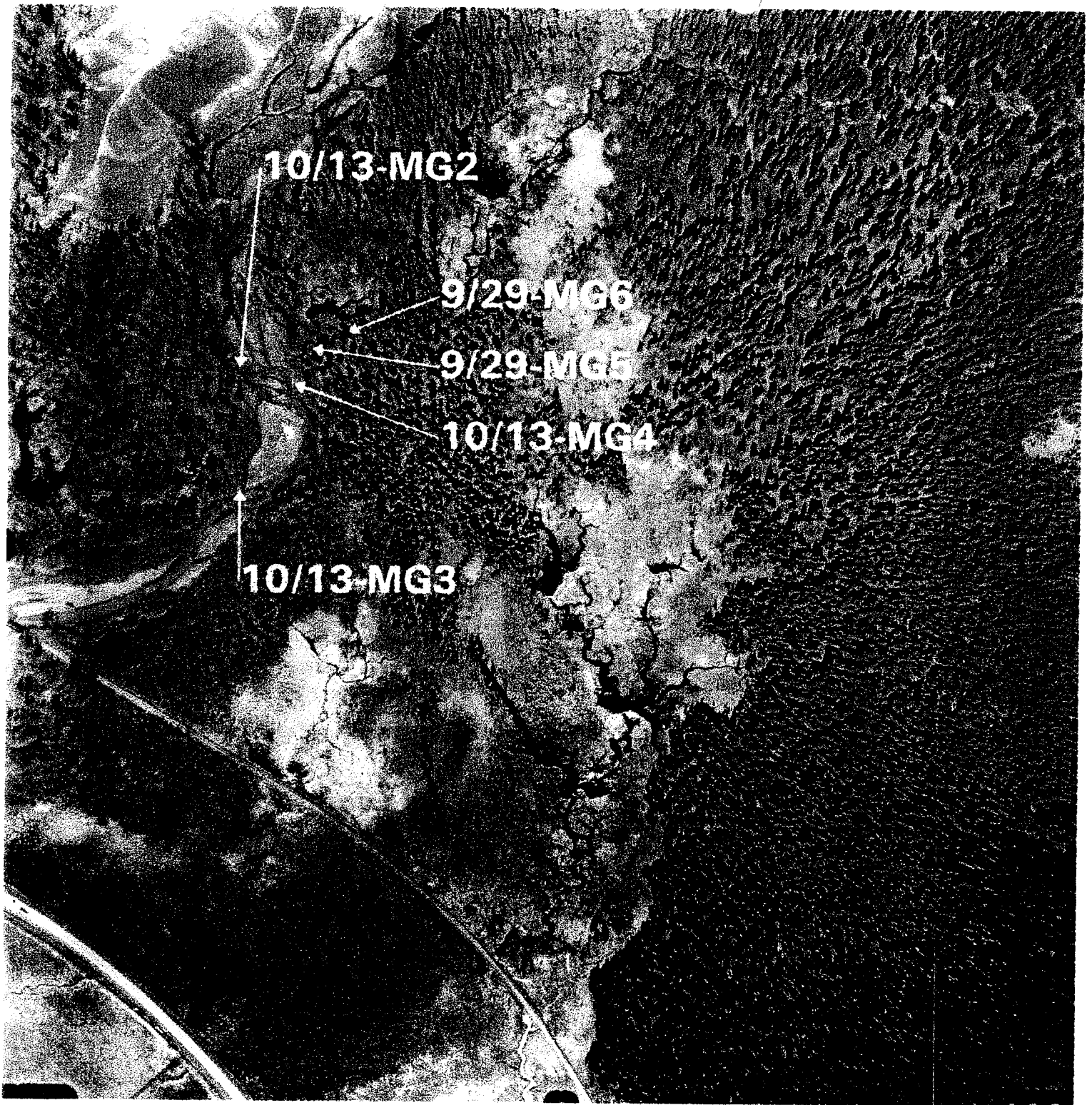


Figure 9. Glacier Creek Juvenile trap sites.

Aerial Photo # 59-5

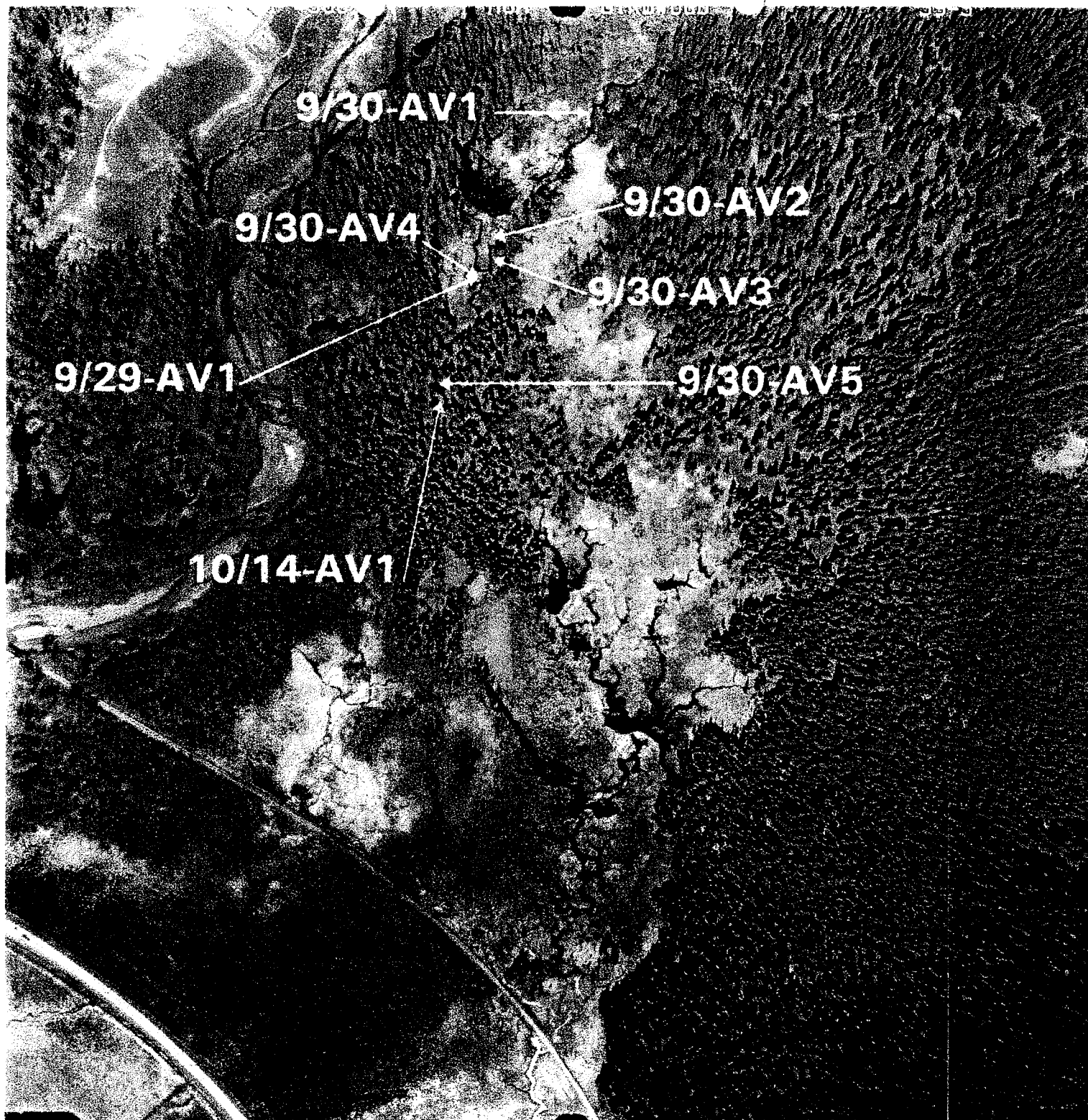


Figure 10. Virgin Creek adult observation sites.

Aerial Photo # 59-5

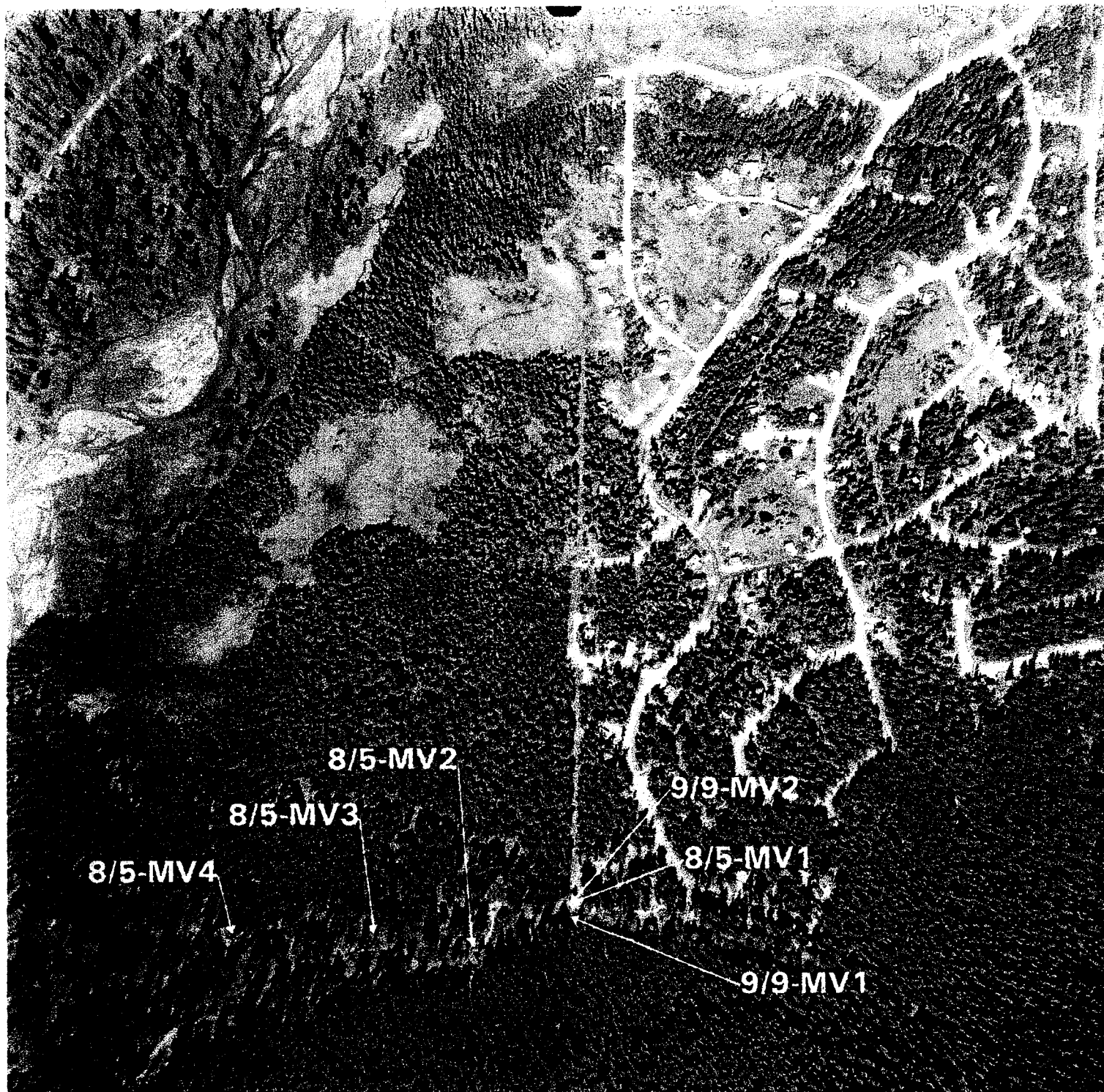


Figure 11. Virgin Creek juvenile trap sites.

Aerial Photo # 60-8

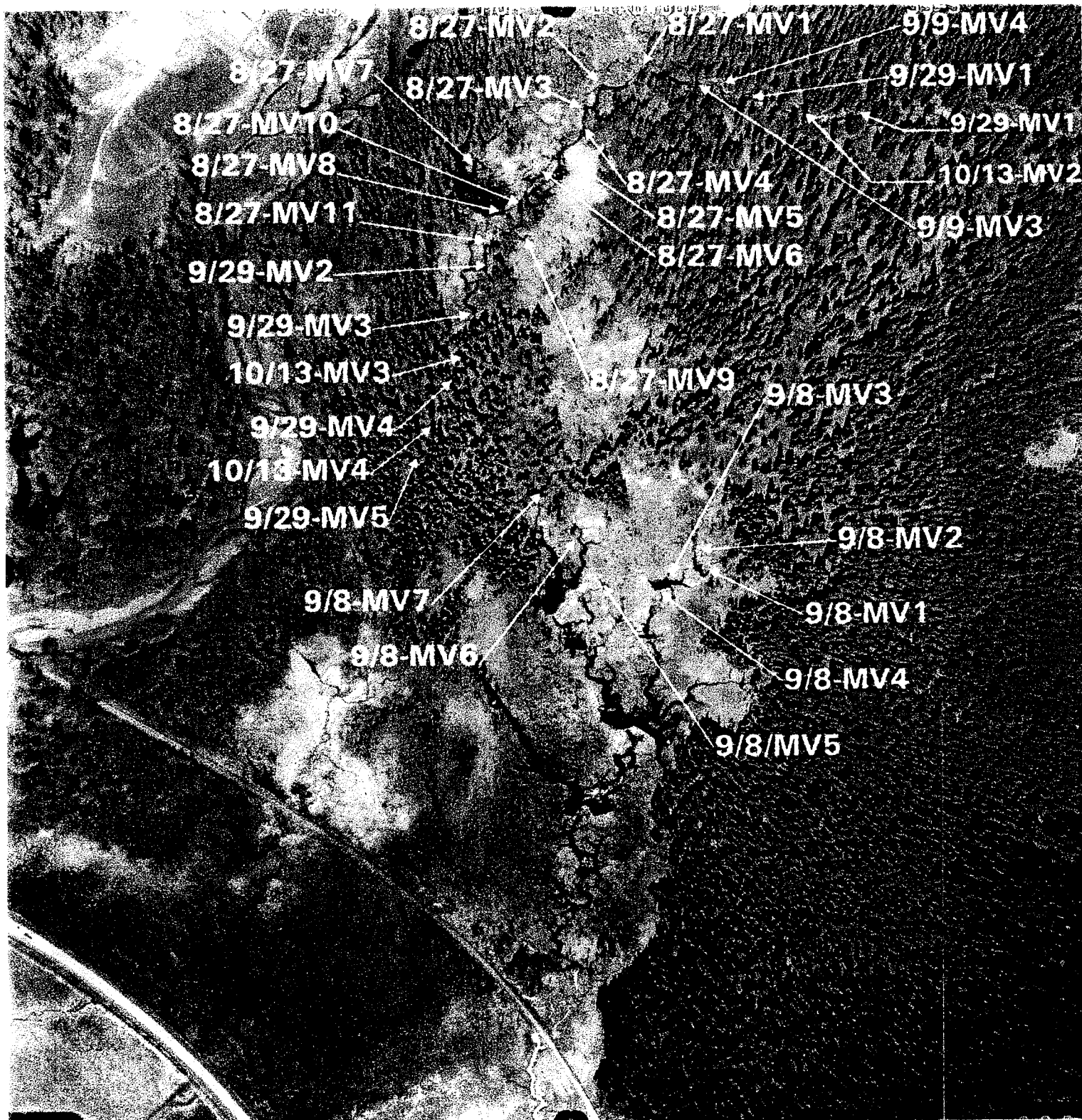
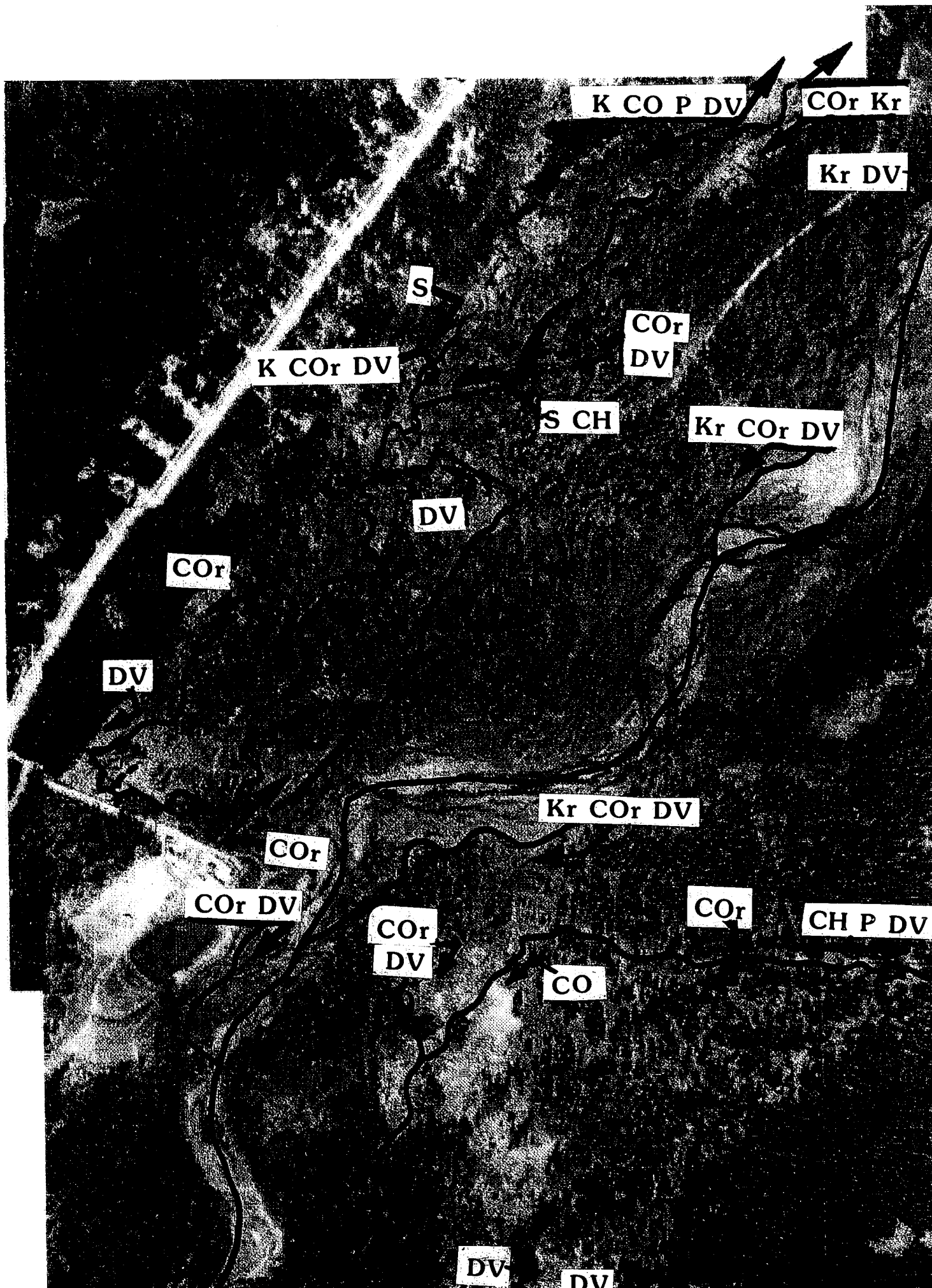


Figure 12. Virgin Creek juvenile trap sites.

Aerial Photo # 59-5



K CO P DV

COOr Kr

Kr DV

S

K COOr DV

COOr
DV

S CH

Kr COOr DV

DV

COOr

DV

Kr COOr DV

COOr

COOr DV

COOr
DV

COOr

CH P DV

CO

DV

DV